Structures and Mechanisms Design (NE-XD)

Provides the Exploration Systems and Operations Division with design capabilities for ground support equipment, ground systems, facilities, analog space environment test systems, and flight systems to meet current and future space flight customer needs.

Tyler Munroe
University of South Florida
Mechanical Engineering
Pathway Intern since 2016

Responsibilities

- Assist in the design and analysis for various projects assigned to NE-XD
- Model components and assemblies using CAD
- Upload and update models in Kennedy Space Center Design and Data Management System (KDDMS)
- Communicate with team members and manufacturers to ensure proper design intent

Engineering Design

The process of design is essentially an exercise in applied creativity. Once a need is identified the design process can begin to take shape. The design process can vary greatly for different projects some processes have only a few steps while others can have up to 25 different detailed steps.

10 step design process:

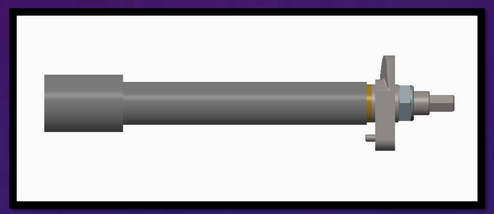
- Identification of need
- Background research
- Goal statement
- Task specifications
- Synthesis
- Analysis
- Selection
- Detailed design
- Prototyping and testing
- Production

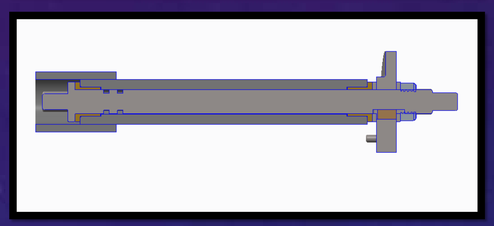
The design process is never linear. Many iterations are required for each step to complete the process.

Main Projects

BP-3 Hatch Modifications

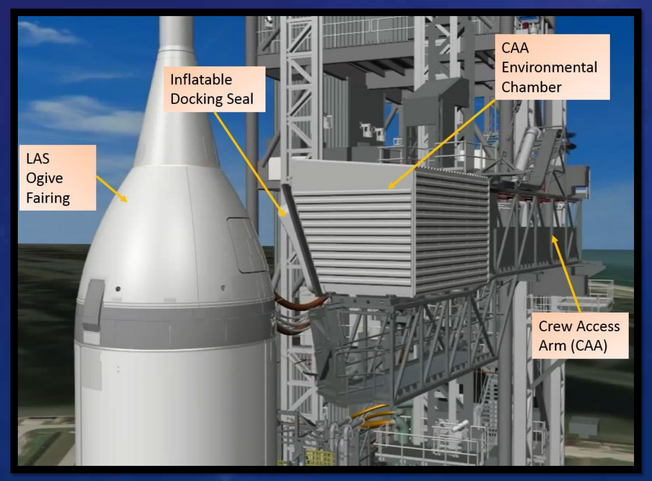
The Boeing Boilerplate 3 (BP-3) is a full scale mockup of the Crew Space Transportation Capsule (CST-100) that will be used in training activities for water environment recovery and rescue. The CST-100 is the spacecraft that will be used to send humans and cargo into space and return them to earth. NE-XD was tasked with modifying the hatch for a more accurate mockup. Some of the design modifications included a functioning handle mechanism to mimic the required opening force and rotation for the CST-100 and modeling a two-way sealing mechanism to ensure the hatch is watertight.

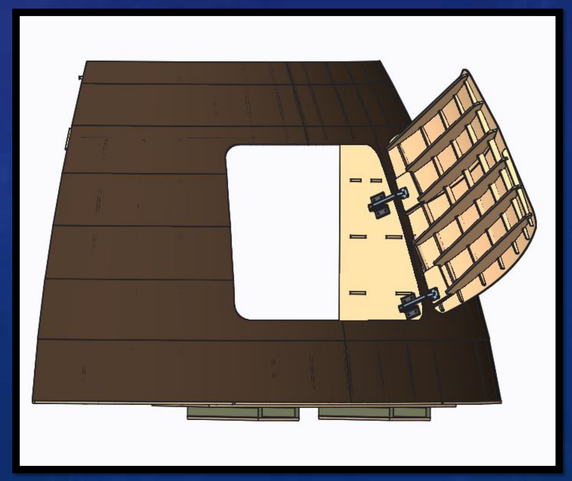




LAS Mockup

Adjusted the CAD dimensions for the Launch Abort System (LAS) fairing mockup. The LAS fairing is a component to the Launch Abort System which is positioned atop the Orion Capsule. The LAS is designed to protect astronauts if a problem arises during launch by pulling the spacecraft away from the failing rocket. The mockup is needed to test the inflatable docking seal (IDS). The IDS is located between the environmental chamber (EC) attached to the Crew Access Arm (CAA) and the LAS fairing. The seal responds to various gap sizes between the two objects, therefore the operation of the seal needs to be properly verified before use. The models components thickness needed to match that of the material being used to construct the mockup. Once the adjustments were made the components needed to be constrained to each other to form an assembly. The design was to use tabs and slots to assemble the structure therefore it was crucial that the dimensions were correct so the components could be constrained to each other.





Additional Projects

- Mounting frame for bending specimen test fixtures
  - Fixtures used to test the bending moment and mechanism functionality in order to ensure correct stress intensities of a titanium alloy in a hypergolic fuel.
- Parabolic mirror work stand
  - Swamp Works, an advanced projects laboratory at KSC, requested a work stand to be built using an existing frame of a parabolic mirror that was used during the shuttle program.
- Quick-release pin locks
  - Located on the Core Stage Inter Tank Umbilical (CSITU) for the Space Launch System (SLS). The locks allow the positioning of the CSITU without having to keep the pins manually retracted throughout the entire process.

Skills Learned

- 3D modeling using Creo Parametric 2.0
- Implementation of mechanical engineering fundamentals into real world application
- Using MATHCAD to display analysis in a clear and precise manner
- Gained knowledge of different manufacturing processes
- General Dimensioning and Tolerancing